Texas A&M University Department of Physics and Astronomy is an institutional member of:

Munnerlyn Astronomical Instrumentation Lab, Texas A&M University

GMT

HETDEX Illuminating the Darkness — Hobby-Eberly Telescope Dark Energy Experiment

LSST Large Synoptic Survey Telescope

DARK ENERGY SURVEY

ASTRONOMY TEXAS A&M UNIVERSITY

Instrument Design for DESpec

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History

- DESpec began as a notion
  - Could we modify DECam infrastructure to accommodate a spectroscopic survey?
    - Possible?
    - Inexpensive
  - Would the enabled spectroscopic survey be scientifically interesting?
    - Meaningfully increase DE parameter precision?

Answers seem to be positive

- Can reconfigure DECam to allow for spectroscopic option
  - Additional optics
  - Fiber positioner/spectrographs
- Use a large fraction of existing DECam infrastructure
  - Corrector optics
  - Structure (cage, etc.)
  - Hexapod
- Cost is not prohibitive

Answers seem to be positive

- DE parameter precision could increase substantially
  - Factors of many
  - Many talks and lots of discussion about what "many" means
- Additional science enabled
  - Talks and discussion of this as well

Many options remain available

- Specific starting point of discussion
  - 500 – 1000nm coverage
  - Resolution of ~3000
  - ~4000 targetable fibers
  - ~3 square-degree field-of-view
- Guidelines, not specifications
  - Other choices are possible
  - Some are more difficult/expensive than others
- Need to transition to science-based decisions abot instrumentation

Example: specific red cutoff

- Can use existing corrector to ~1050 nm
  - Can use simultaneously from 500-1050 nm
- Beyond ~940 nm
  - Throughput falls quickly
  - Sky becomes brighter
  - Water absorption
- Note: [OII] 372.7 nm at z=1.5 is at 931.75 nm
- Need to assess the importance of observing at wavelengths longer than ~940 nm

Example: Blue spectra

- DECam optics make good images over any ~200 nm wavelength range from ~350 nm to ~1050 nm
  - In the red the accessible range is larger
  - Blue observations are possible
    - 350-550 nm, for example
- Complications
  - Focus position different
  - Fiber material different
  - ADC more important
- Need to understand utility and added science

Quantitative discussion of added science capability

- Quantitative gain versus added capability is crucial for future instrumentation decisions
  - Ideally want something like "FOM vs red cutoff"
- Allows for examination of instrumentation designs and cost
- As a group we could then discuss "cost versus benefit" trade-offs

Some things are easy to change; others hard (= costly)

- Resolution
  - 1000-5000 possible
  - >10000 is difficult
- Field-of-view
  - ~3 square degrees possible
  - More is difficult
- Wavelength range
  - ~550-1050 nm possible
    - Reduction within this range easy
  - Anything else is difficult
- Etc.
- But nothing is impossible